

25065-31

U.S. APPLICATION NO (IF KNOWN, SEE 37 CFR

10/089859

INTERNATIONAL APPLICATION NO.
PCT/RU00/00208INTERNATIONAL FILING DATE
31 MAY 2000 (31.05.00)PRIORITY DATE CLAIMED
05 OCTOBER 1999 (05.10.99)

TITLE OF INVENTION

ANODE

APPLICANT(S) FOR DO/EO/US

Nickolay Vladimirovich KHODOV

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. is attached hereto (required only if not communicated by the International Bureau).
 - b. has been communicated by the International Bureau.
 - c. is not required, as the application was filed in the United States Receiving Office (RO/PS).
6. An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. is attached hereto.
 - b. has been previously submitted under 35 U.S.C. 154(d)(4).
7. Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. are attached hereto (required only if not communicated by the International Bureau).
 - b. have been communicated by the International Bureau.
 - c. have not been made; however, the time limit for making such amendments has NOT expired.
 - d. have not been made and will not be made.
8. An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. A **FIRST** preliminary amendment.
16. A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. A substitute specification.
18. A change of power of attorney and/or address letter.
19. A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. Certificate of Mailing by Express Mail
23. Other items or information:

I hereby certify that this paper or fees is being deposited with the U.S. Postal Service "Express Mail" Post Office to Addressee" service under 37 CFR 1.10 on the date indicated below and addressed to the Commissioner of Patents and Trademarks, Washington, DC 20231.

K. D. [Signature]
DATE: April 3, 2002
EXPRESS MAIL NO. ET035788274US

Applicant requests that examination commence on the basis of the amended claim language, provided via the translation of the Annex to the IPER.

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 107089859	INTERNATIONAL APPLICATION NO. PCT/RU00/00208	ATTORNEY'S DOCKET NUMBER 25065-31																
24. The following fees are submitted:		CALCULATIONS PTO USE ONLY																
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :																		
<input checked="" type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1040.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$740.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00																		
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$1,040.00																
Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)).		<input type="checkbox"/> 20 <input type="checkbox"/> 30 \$0.00																
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">CLAIMS</th> <th style="width: 25%;">NUMBER FILED</th> <th style="width: 25%;">NUMBER EXTRA</th> <th style="width: 25%;">RATE</th> </tr> </thead> <tbody> <tr> <td>Total claims</td> <td>1 - 20 =</td> <td>0</td> <td>x \$18.00 \$0.00</td> </tr> <tr> <td>Independent claims</td> <td>1 - 3 =</td> <td>0</td> <td>x \$84.00 \$0.00</td> </tr> <tr> <td colspan="2">Multiple Dependent Claims (check if applicable)</td> <td></td> <td style="text-align: center;"><input type="checkbox"/> \$0.00</td> </tr> </tbody> </table>		CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	Total claims	1 - 20 =	0	x \$18.00 \$0.00	Independent claims	1 - 3 =	0	x \$84.00 \$0.00	Multiple Dependent Claims (check if applicable)			<input type="checkbox"/> \$0.00	
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Multiple Dependent Claims (check if applicable)			<input type="checkbox"/> \$0.00															
TOTAL OF ABOVE CALCULATIONS =		\$1,040.00																
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.		\$520.00																
SUBTOTAL =		\$520.00																
Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).		<input type="checkbox"/> 20 <input type="checkbox"/> 30 + \$0.00																
TOTAL NATIONAL FEE =		\$520.00																
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).		<input type="checkbox"/> \$0.00																
TOTAL FEES ENCLOSED =		\$520.00																
		Amount to be: refunded \$ charged \$																
<p>a. <input checked="" type="checkbox"/> A check in the amount of \$520.00 to cover the above fees is enclosed.</p> <p>b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 08-0719 A duplicate copy of this sheet is enclosed.</p> <p>d. <input type="checkbox"/> Fees are to be charged to a credit card. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.</p>																		
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.																		
SEND ALL CORRESPONDENCE TO:																		
<p>John B. Hardaway, III NEXSEN PRUET JACOBS & POLLARD, LLC P.O. Box 10107 Greenville, South Carolina 29603 United States of America</p> 																		
<p>J. Herbert O'Toole NAME _____ 31,404 REGISTRATION NUMBER _____ 03 April 2002 DATE _____</p>																		

ANODE

Technical Field

This invention relates generally to electrochemical production practice and
5 more specifically, to anodes.

Background Art

Some prior-art anodes are known to comprise a titanium base coated with
an active coating from manganese dioxide, such anodes being produced by
intermixing powdered titanium and powdered manganese, followed by molding
10 and sintering the resultant mixture, applying a manganese nitrate solution to said
base, and heat-treatment of the latter (cf. US Patent No4,269,691, IPC C 25 B
11/16, 1981).

The closest to the herein-proposed invention as to its technical essence and
the obtainable result is an anode as disclosed in the USSR Inventor's Certificate
15 No1,713,983, IPC C 25 B 11/16, 1989. The anode in question comprises a
titanium base appearing as a rod made of a titanium alloy to which a manganese-
dioxide coating is applied, using any heretofore-known technique, viz., direct
electrolytic deposition of manganese dioxide or thermal decomposition of a
solution containing sulfuric acid and manganese sulfate.

20 However, said known anodes suffer from a number of disadvantages,
namely, poor adhesion of a layer of manganese dioxide to the titanium metal
base; an increase in the anode potential to an impermissible high value (over 2.5
V); a considerable difference between the values of the thermal expansion
coefficient of titanium and of manganese dioxide resulting in destruction of the
25 manganese dioxide layer and separation of large coating areas which as a whole
affects adversely the quality of a finished anode due to titanium passivation.

With a view to increasing the adhesive properties of manganese dioxide towards the titanium base attempts were made to subject the surface of said base to special perforating; however, said procedure only added to complexity of the anode production process.

5

Disclosure of the Invention

It is a principal object of the present invention to provide a titanium-base anode, wherein the manganese-dioxide layer thereof features higher adhesive properties towards said titanium base, as well as a higher strength of said coating layer, with a simple production process of said anode.

10

Said object is accomplished due to the fact that in an anode comprising a titanium base coated with a manganese-dioxide coating, according to the invention, the titanium base appears as a plate made of porous titanium and having a thickness of 3 mm and over and a void content of from 5 to 45%.

15

While being crystallized in the initial period of time in the voids of the titanium base and then on the surface of said base-plate, manganese dioxide forms strong bonds throughout the bulk of the anode, said bonds preventing the exterior layer from spalling and the anode itself from passivation. Effect of a difference between the values of the thermal expansion coefficient of manganese dioxide and of titanium on the strength of coating is much reduced due to the fact 20 that the exterior working layer of manganese dioxide is crystallized predominantly on those manganese-dioxide crystals which have grown into the voids of the titanium base which in this particular case serves as a metal framework of the entire anode, adapted to impart bending and tensile strength to the anode and to serve as a current-carrying element of the working member of 25 the manganese-dioxide anode.

The lower limit of thickness of the porous titanium base depends on the required bending and tensile strength of the anode, as well as electric conductance thereof. Provision of the titanium base more than 5 mm thick does not affect the technological characteristics of the anode but results in an unjustified increase in the production costs of the anode due to a higher consumption of titanium.

The lower limit of the void content of the titanium base (below 5%) is dictated by the production capability of said porous plate and by poor adhesion of manganese dioxide to said base, and rather frequent spalling of the manganese-dioxide layer. It is recommended that the lower limit of the void content preferably be at 25%.

The upper limit of the titanium base void content, i.e., 45% is determined by economic expediency in view of the fact that any increase in the void content of the titanium base will result in a higher consumption of the agents involved in establishing a required manganese-dioxide layer and in a reduced bending strength of the titanium base due to higher brittleness of the plate, whereby said upper limit of the titanium base void content is recommendable to lie within 40%.

In what follows the invention will be disclosed in its specification with reference to a specific embodiment thereof.

Best Method of Carrying Out the Invention

Used for producing an anode a plate having a thickness of 4.1 mm and measuring 1100 x 800 mm made of porous titanium having the void content of 25%. The plate having the aforesaid dimensions was positioned horizontally and was coated with a manganese-nitrate solution having a density of 1.65 kg/cu.m, using a brush. Next the applied layer, i.e., a manganese-nitrate coating, was

heated in a furnace provided with an exhaust system, at a temperature $T = 200$ to 250°C . As a result of heating, manganese nitrate is decomposed into manganese dioxide and nitrogen dioxide, the latter being removed, while manganese dioxide is deposited on the porous titanium base to crystallize in the voids of the titanium plate in the initial period of time. The step of applying a manganese-dioxide layer on the plate was repeated ten times in succession, with the result that manganese dioxide crystallized over the entire surface of the porous titanium plate to form a strong bond within the whole bulk of the anode. Hence with the original weight of the titanium plate equal to 8.2 kg, a finished anode was obtained, weighing 12.3 kg and comprising a porous titanium base, i.e., the plate coated with a manganese-dioxide coating.

Given below is a table representing the main anode characteristics, that is, duration of continuous operation and spalling area vs the void content of the titanium plate, the initial two lines presenting the characteristics of the heretofore-known anodes, i.e., those having a titanium base.

Table

Material of anode base	Void content, %	Continuous operation time, h	Bath voltage, V	Spalling area, %
1	2	3	4	5
1. Titanium sheets, perforation-free	0	14	5.7	20.2
	0	25	7.8	73.0
2. Titanium sheets, perforated	0	216	5.8	15.5
3. Porous plate	5	350	6.7	2.5
4. Porous plate	15	200	5.1	8.9
5. Porous plate	20	250	4.9	4.5
		350	4.7	3.1

1	2	3	4	5
6. Porous plate	25	350	3.4	0
7. Porous plate	25	700	3.4	0
8. Porous plate	30	1000	3.4	0
9. Porous plate	40	1000	3.4	0
10. Porous plate	45	970	3.6	1.6

Industrial Applicability

The present invention can find application for electrolysis of zinc- and other solutions or in producing electrolytic zinc.

CLAIMS

An anode, comprising a titanium base, coated with a manganese-dioxide coating, CHARACTERIZED in that said base in the form of a plate of porous titanium with a thickness of 3 mm and more and a porosity of 5 to 45 %.

CLAIMS

An anode for electrolysis of zinc- and other solutions, comprising a titanium base appearing as a plate made from porous titanium and having a thickness of 3 mm and over, coated with a manganese-dioxide coating, CHARACTERIZED in that said plate has the same void content uniform throughout the bulk of the anode, strong bonds being established between manganese dioxide and the titanium base, said bonds preventing the exterior layer from spalling and the anode from passivating, the void content being from 5 to 29%.

алм

(12) МЕЖДУНАРОДНАЯ ЗАЯВКА, ОПУБЛИКОВАННАЯ В СООТВЕТСТВИИ С
ДОГОВОРОМ О ПАТЕНТНОЙ КООПЕРАЦИИ (РСТ)

(19) ВСЕМИРНАЯ ОРГАНИЗАЦИЯ
ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ
Международное бюро

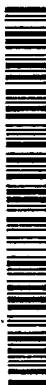


(43) Дата международной публикации:
12 апреля 2001 (12.04.2001)

PCT

(10) Номер международной публикации:
WO 01/25509 A1

- (51) Международная патентная классификация⁷: C25B 11/10
- (21) Номер международной заявки: PCT/RU00/00208
- (22) Дата международной подачи: 31 мая 2000 (31.05.2000)
- (25) Язык подачи: русский
- (26) Язык публикации: русский
- (30) Данные о приоритете: 99120650 5 октября 1999 (05.10.1999) RU
- (71) Заявитель и
(72) Изобретатель: ХОДОВ Николай Владимирович [RU/RU]; 362003 Владикавказ, ул. К.Маркса, д. 46, кв. 4 (RU) [KHODOV, Nikolai Vladimirovich, Vladikavkaz (RU)].
- (74) Агент: ФИРМА «ЦЕНТР ПАТЕНТНЫХ УСЛУГ»; 117279 Москва, ул. Миклухо-Маклая, д. 55а (RU) [FIRM «PATENT SERVICES CENTRE», Moscow (RU)].
- (81) Указанные государства (*национально*): AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (84) Указанные государства (*регионально*): ARIPO патент (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), евразийский патент (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), европейский патент (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), патент OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- Опубликована**
С отчётом о международном поиске.
С изменённой формулой изобретения и
объяснением.
- В отношении двухбуквенных кодов, кодов языков и других сокращений см. «Пояснения к кодам и сокращениям», публикуемые в начале каждого очередного выпуска Бюллетеня РСТ.*



A1

WO 01/25509

(54) Title: ANODE

(54) Название изобретения: АНОД

(57) Abstract: The invention relates to a titanium-based anode in the form of a plate of porous titanium with a thickness of 3 mm and more and a porosity of 5 to 45 %.

(57) Реферат: Предлагается анод на титановой основе, которая представляет собой пластину из пористого титана от 3 мм и выше и пористостью от 5 до 45%.

**COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION**

Attorney Docket
Number: 25065- 31

DECLARATION: As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled
ANODE

the specification of which:

is attached hereto.

was filed on 31 May 2000 as PCT Application Number PCT/RU00/00208 and amended on 18 October 2000
(if applicable.)

09 August 2001

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119 (a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States listed below, and have also identified below any foreign application for patent or inventor's certificate or PCT international application having a filing date before that of the application on which priority is claimed:

<u>99120650</u> (Number)	<u>RU</u> (Country)	<u>(05/10/99)</u> Filed (Day/Month/Year)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<u> </u> (Number)	<u> </u> (Country)	<u> </u> Filed (Day/Month/Year)	<input type="checkbox"/> Yes <input type="checkbox"/> No

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

<u> </u> (Application Serial No.)	<u> </u> (Filing Date)	<u> </u> (Application Serial No.)	<u> </u> (Filing Date)
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I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT application(s) in the manner provided by the first paragraph of 35 U.S.C. §112. I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56 which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

<u> </u> (Application Serial No.)	<u> </u> (Filing Date)	<u> </u> (Status - patented, pending, abandoned)
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POWER OF ATTORNEY: I hereby appoint the following attorneys and/or agents to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: John B. Hardaway, III, Reg. No. 26,554; Michael A. Mann, Reg. No. 32,825; Joseph T. Guy, Reg. No. 35,172; William Y. Klett, III, Reg. No. 41,903; J. Herbert O'Toole, Reg. No. 31,404; Timothy J. Slabouz, Reg. No. 47,949; Charles L. Schwab, Reg. No. 17,497; Oscar A. Towler, III, Reg. No. 33,803; Townsend M. Belser, Jr., Reg. No. 22,956.

SEND ALL CORRESPONDENCE TO: John B. Hardaway, III, NEXSEN PRUET JACOBS & POLLARD, I.L.C., P.O. Box 10107, Greenville, South Carolina, 29603 TELEPHONE NUMBER: (864) 370-2211.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

FULL NAME OF INVENTOR (given name, family name) Nickolay Vladimirovich, KHODOV
Complete Post Office Address Vladikavkaz, 362003, Russian Federation
City and Country of Residence Vladikavkaz, 362003, Russian Federation **Citizenship** RU

Inventor's Signature 

RVX

Date 1.04.2002